

CLEAN VERSION OF AMENDED SPECIFICATION PARAGRAPHS

IMPROVED COATING COMPOSITIONS

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Cross-Reference to Related Application

This application is a divisional application of U.S. Patent Application No. 09/260,958, filed March 2, 1999, which is incorporated herein by reference.

Any epoxy resin may be included in the epoxy resin-based polymer. Typically, the epoxy resin includes glycidyl polyethers having one or more epoxide group per molecule (i.e., glycidyl ethers containing an average of at least one and generally greater than 1.0 epoxy groups per molecule). The glycidyl polyethers commonly have an average of about 2.0 to about 2.5 epoxide groups per molecule. Diglycidyl ethers of dihydric phenols, such as is Bisphenol A (p,p'-dihydroxy-2,2-diphenyl propane), are particularly suitable. The epoxy resins typically used in the present invention may be derived from the reaction of dihydric phenol and an epichlorohydrin, such as epichlorohydrin. Epoxy resins based on Bisphenol A and epichlorohydrin are especially suitable, because these compounds have been approved in the United States by the Food and Drug Administration for use in can coatings.

The film-forming component of the coating compositions of the present invention also contains polyvinyl alcoholic-containing phenolic resin. This resin may be made by reacting a mixture including a phenol, an aldehyde and a polyvinyl alcoholic compound, such as specified in U.S. Patent Application Serial No. 09/032,907 filed on March 2, 1998, by Warakomski, entitled "Phenolic Thermosetting Resins Containing Polyols" (hereinafter "Warakomski"), which is incorporated herein by reference. The phenolic resin can be formed by reacting a phenol and formaldehyde in the presence of a polymerization catalyst, and a polyvinyl alcoholic compound. The phenol may include an alkyl phenol, a bisphenol or mixtures thereof. Examples of suitable

alkyl phenols include those containing from 7 to 20 carbon atoms, such as p-tertiary octyl phenol, p-tertiary butylphenol, nonyl phenol and dodecyl phenol. Examples of suitable bisphenols include Bisphenol A (4,4'-isopropylidenediphenol), Bisphenol F (4,4'-methylenebisphenol) and Bisphenol S (4,4'-sulfonylbisphenol). Bisphenol A is especially suitable for use in the present invention. The molar ratio of formaldehyde to the phenol is generally about 1:1 to about 1:3, and preferably about 1:1.5 to about 1:2.5.

The polyvinyl alcoholic compound includes polyvinyl alcohols and protected versions thereof, such as complete or partial esters of polyvinyl alcohol and acetals derived from polyvinyl alcohol including polyvinyl butyral and polyvinyl formal. The polyvinyl alcoholic compound can be produced by polymerizing a vinyl ester to produce a polyvinyl ester. The ester groups are then [hydrolyzed]hydrolyzed either partially or fully to generate [hydroxyl]hydroxyl groups. The hydroxyl groups may be [derivitized]derivatized by reaction with an aldehyde or ketone to produce acetal functional groups, which is, for example, one form of a protected polyvinyl alcohol. Particularly suitable polyvinyl alcoholic compounds for use in the present invention include partially hydrolyzed polyvinyl acetates, a commercial example of which is grade 205 polyvinyl alcohol sold by Air Products.

The resinous material was allowed to cool to 94 °C. Upon cooling, 45.5 parts Durez 33-345, a [commercial]commercial polyvinyl alcoholic-containing resin (Occidental Chemical Corporation, Dallas, TX), was added, followed by agitation for 30 minutes. The heating mantle was set at 75 °C, and water dispersion was initiated by adding 682.9 parts deionized water at a rate of 25 ml every 10 minutes. Inversion occurred approximately one and one-half hours after commencement of the water addition, at which time the heating mantle was removed. The water addition continued until completion and the dispersion was agitated for one and one-half hours with passive cooling to ambient temperature. The final composition contained 44.1% solids and had an average particle size of 0.21 micrometers.